5808

Network Working Group
Request for Comments: 109

NIC #5808

March 24, 1971

Joel M. Winett
MIT Lincoln Laboratory

Level III Server Protocol for the Lincoln Laboratory 360/67 Host

This material has not been reviewed for public release and is intended only for use with the ARPA network. It should not be quoted or cited in any publication not related to the ARPA network.

TO: NIC

FROM: Joel M. Winett (LL)

SUBJECT: Level III Server Protocol for the Lincoln Laboratory 360/67 Host

Introduction

The Lincoln Laboratory IBM 360/67 is connected to the ARPA network and acts as a serving host providing access to the CP-67 virtual machine operating system. Upon completion of the Login procedure, users have control of a 360 virtual machine through a virtual 1052 online console. Attached to the virtual machine is a virtual card reader, card punch and line printer, and a number of disk storage devices. The 360 virtual machine can be either a virtual 360/67 with dynamic address translation hardware or a standard System/360. Most users run a standard 360 with 256K bytes of virtual memory and operate the CMS conversational monitor system. CMS provides facilities for file creation, maintenance and manipulation, program development, debugging and execution, and a number of other useful utility functions. The section in the Network Resource Notebook on the Lincoln Laboratory 360/67 more fully describes the facilities available.

Network Control Program

All communications with the 360/67 through the IMPare processed by a Network Control Program (NCP). The NCP operates with the Host-Host Protocol described in the Network Working Group Document No. 1 dated 3 August 1970.

Initial Connection Protocol

To create a virtual machine from the network, a pair of connections must be made with the LOGGER. The sockets to be used are assigned following the Initial Connection Protocol (ICP). The LOGGER is enabled and waiting for an RTS control command for socket X'0A 0000 01'. This ICP socket corresponds to home X'0A', user X'0000', and tag X'01' (send gender). Requests for connection on the ICP socket are stacked until it becomes free. If the LOGGER is willing to service another network user, a 32 bit socket ID of a receive socket will be sent over this initial connection and the ICP socket will then be closed. If the LOGGER is not willing to service another network user, it will not complete the initial connection for the ICP socket and will refuse the request by closing the connection without completing it.

LOGGER Protocol

Once a pair of user sockets have been assigned, the connection protocol should be completed on these sockets. The LOGGER then expects to receive (on the receive socket) one 8-bit byte indicating the data type which characterizes the transmission code used to communicate with the network user over this pair of sockets. A code of X'01' implies 7 bit ASCII code in 8-bit bytes with the leading bit zero. A code of X'02' implies 8-bit EBCDIC code. When the data type code is received, the LOGGER will echo back the data type code over the send socket followed by the message:

LINCOLN LABORATORY CP-67 ONLINE (NL)

in the appropriate code. (In ASCII, NL is transmitted as CR LF).

The procedure continues according to the normal CP-67 login protocol with the LOGGER performing an additional function of mapping network userids and passwords into valid CP-67 userids and passwords. This mapping is specified by entries in a file (the LOGGER FILE) which the LOGGER accesses. If a network userid does not match an entry in the file or if the password given does not match

the corresponding network password, the usual CP responses will be sent to the users. Thus network access to the Lincoln Laboratory system is restricted to those accounts for which an appropriate entry has been made in the LOGGER FILE.

It should be noted that CP transmits a BYP code (Bypass) to suspend the printing of characters keyed while a password is being entered. After the password has been entered, CP transmits a RES code (Restore) to resume the printing when characters are keyed. When communicating in ASCII, these character codes are converted to X'FF' since no corresponding ASCII code is defined. Refer to the Network Resource Notebook for more details on CP-67 and on CMS.

The NET Account

Lincoln Laboratory is providing one account which can be used by network users to familiarize themselves with our time-sharing system. The userid of this account is NET and the password is ARPA. This account has 900 records of storage, which can store approximately 720,000 characters. NET users are free to ERASE any file on this account since many different people may use the account.

The SERVER Protocol

CP-67 operates on a line at a time, i.e., a group of characters are processed as a line and not as a sequence of individual characters. Also, the system does normally buffer input lines, that is, input is not normally entered until requested by a read from the system. With IBM 2741 or 1052 terminals, the keyboard is locked until a read is requested. The virtual terminals through which network users have access to the CP-67 system have been designed to support either a line oriented terminal or a character oriented terminal. When CP requests a line of input, the SERVER transmits a prompting code X'80'. This character can be used to signal a user process to change transmission modes and to transmit an input line. Characters received by the SERVER are buffered until a NL character is received. Lines received can then be used to satisfy CP requests for an input line.

CP may send out lines which may or may not end with a NL character. If a line does not end with a NL character, the prompting character will usually be sent following the output line to request input to a CP process.

When a user wishes to interrupt a CP process, i.e., to change modes, an interrupt code X'80' should be sent to the SERVER. This code will result in an asynchronous interrupt being sent to the running process, simulating the pressing of the 'attention' button on a 2741 terminal. Together with the transmission of the interrupt code, the user should cause an INS to be sent over the send link. This signal will be synchronized with the interrupt code. If the interrupt code has not yet been received and processed, all characters buffered and those received before the receipt of the interrupt code will be flushed, i.e., deleted. When the interrupt code is received, it will be paired with the previously received INS. If an INS is received after an interrupt code has been received and processed, the INS will be paired with this previously received interrupt code.

If CP has a line to send to a user after it has requested an input line but before it has received any input, the SERVER will transmit an INS on the user's receive link to notify the user that the previously sent prompting character should be retracted and that a line has been or will be sent to the user. This message line is called a "warning".

Graphic and Control Codes

Figure 1 gives the 8-bit codes for the EBCDIC graphics and controls. Figure 2 gives the 7-bit codes for the ASCII graphics and controls. The controls are tabulated and compared in Figure 3. The standard interpretations of the ASCII controls are given in Figure 4.

There are 4 ASCII codes which do not have a corresponding graphic or control in the EBCDIC code. The EBCDIC codes given to these codes are as follows:

ASCII Symbol	Hex Code	
	ASCII	EBCDIC
DC3	13	3A
`	60	70
\	5C	71
^	5E	72

There are 29 EBCDIC graphics codes and 19 EBCDIC control codes which do not have a corresponding graphic or control in the ASCII code. In addition, there are 84 other EBCDIC codes whose interpretation is unspecified. Four of these codes have been chosen to correspond to the ASCII control and ASCII graphics which do not have a corresponding EBCDIC code. When converting EBCDIC codes to ASCII codes, the remaining 80 codes plus the 29 EBCDIC graphics and 18 EBCDIC controls (not counting NL) are converted into the code X'FF'. The NL character is treated specially. The NL character, EBCDIC code X'15', is converted into the two character sequence CR LF, i.e., ASCII X'0D 0A'. As stated above, the code X'80' is transmitted as a prompting character whenever CP requests an input line.

On converting from ASCII to EBCDIC, if any code other than the 128 ASCII codes, or the interrupt code, X'80', is received, it is converted to the code X'FF'. In addition, whenever the two ASCII characters CR LF are found sequencially in the input stream, they are converted into the single EBCDIC character NL.

Joel M. Winett

JMW/sa
Attachments

	0 0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	1 0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
	2 0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
	3 0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
4567																
0000	NUL	DLE	DS		SP	&	-				-	0				0
0001	SOH	DC1	SOS				/		a	j	°	1	A	J		1
0010	STX	DC2	FS	SYN					b	k	s	2	B	K	S	2
0011	ETX	TM							c	l	t	3	C	L	T	3
0100	PF	RES	BYP	PN					d	m	u	4	D	M	U	4
0101	HT	NL	LF	RS					e	n	v	5	E	N	V	5
0110	LC	BS	ETB	UC					f	o	w	6	F	C	W	6
0111	DEL	IL	ESC	EOT					g	p	x	7	G	P	X	7
1000		CAN							h	q	y	8	H	Q	Y	8
1001		EM							i	r	z	9	I	R	Z	9
1010	SMM	CC	SM		¢	!	:									
1011	VT	CU1	CU2	CU3	.	$	,	#	{	}	⌞	⌟				
1100	FF	IFS		DC4	<	*	%	@	≤	▫	⌜	⌝				
1101	CR	IGS	ENQ	NAK	(	)	_	'	(	)	[	]				
1110	SO	IRS	ACK		+	;	>	=	+	±	≥	≠				
1111	SI	IUS	BEL	SUB			¬	?	"	+	▫	•	—			

0	1	2	3	4	5	6	7

Code Structure

Figure 1.

Extended Binary-Coded Decimal Interchange Code (EBCDIC)

8	0	0	0	0	0	0	0	0
7	0	0	0	0	1	1	1	1
6	0	0	1	1	0	0	1	1
5	0	1	0	1	0	1	0	1
4321								
0000	NUL	DLE	SP	0	@	P	`	p
0001	SOH	DC1	!	1	A	Q	a	q
0010	STX	DC2	"	2	B	R	b	r
0011	ETX	DC3	#	3	C	S	c	s
0100	EOT	DC4	$	4	D	T	d	t
0101	ENQ	NAK	%	5	E	U	e	u
0110	ACK	SYN	&	6	F	V	f	v
0111	BEL	ETB	'	7	G	W	g	w
1000	BS	CAN	(	8	H	X	h	x
1001	HT	EM	)	9	I	Y	i	y
1010	LF	SUB	*	:	J	Z	j	z
1011	VT	ESC	+	;	K	[	k	{
1100	FF	FS	,	<	L	\	l	|
1101	CR	GS	-	=	M	]	m	}
1110	SO	RS	.	>	N	^	n	~
1111	SI	US	/	?	O	_	o	DEL
	8	7	6	5	4	3	2	1

Code Structure

Figure 2.

USA Standard Code for Information Interchange (USASCII)

CAT	EBCDIC	ASCII	TTY	PTTC	FUNCTION
	NUL	NUL	NULL		Null
CC	SOH	SOH	SOM		Start of Heading
CC	STX	STX	EOA	EOA (D)	Start of Text
CC	ETX	ETX	EOM		End of Text
DC	PF			PF	Punch Off
FE	HT	HT	H.TAB	TAB	Horizontal Tab
GR	LC			LC	Lower Case
	DEL	DEL	RUBOUT	DEL	Delete
	SMM				Start of Manual Message
FE	VT	VT	V.TAB		Vertical Tab
FE	FF	FF	FORM		Form Feed
FE	CR	CR	RETURN		Carriage Return
GR	SO	SO	SO		Shift Out
GR	SI	SI	SI		Shift In
CC	DLE	DLE	DCO		Data Link Escape
DC	DC1	DC1	X-ON		Device Control 1
DC	DC2	DC2	TAPE ON		Device Control 2
	TM				Tape Mark
DC	RES			RES	Restore
FE	NL			NL	New Line
FE	BS	BS		BS	Backspace
	IL			IL	Idle
	CAN	CAN	F30	CAN	Cancel
	EM	EM	S1		End of Medium
	CC				Curser Control
CU	CU1				Customer Use 1
IS	IFS	FS	S4		Info. Field Separator
IS	IGS	GS	S5		Info. Group Separator
IS	IRS	RS	S6		Info. Record Separator
IS	IUS	US	S7		Info Unit Separator
ED	DS				Digit Select
ED	SOS				Start of Significance
ED	FS				Field Separator
DC	BYP			BYP	Bypass
FE	LF	LF	LF	LF	Line Feed
CC	ETB	ETB	LEM	EOB (B)	End of Text Block
	ESC	ESC	S3	PRE	Escape
	SM				Set Mode
CU	CU2				Customer Use 2
CC	ENQ	ENQ	WRU		Enquiry
CC	ACK	ACK	RU	(Y)	Acknowledge
	BEL	BEL	BELL		Bell
CC	SYN	SYN	SYNC		Synchronous Idle
DC	PN			PN	Punch On
DC	RS			RS	Reader Stop
GR	UC			UC	Upper Case
CC	EOT	EOT	EOT	EOT (C)	End of Transmission
CU	CU3				Customer Use 3
DC	DC4	DC4	TAPE OFF		Device Control 4
CC	NAK	NAK	ERROR	(N)	Negative Acknowledge
	SUB	SUB	S2		Substitute
DC		DC3	X-OFF		Device Control 3

Figure 3

Control Functions Compared

CC (Communication Control). A functional character intended to control or facilitate transmission of information over communication networks.

FE (Format Effector). A functional character which controls the layout or positioning or information in printing or display devices.

IS (Information Separator). A character which is used to separate and qualify information in a logical sense. There is a group or four such characters, which are to be used in a hierarchical order.

DC (Device Control). A functional character used for the control of ancillary devices associated with data processing of telecommunication systems, more especially switching devices "on" and "off."

ED (Edit and Mark). A control character used by the System/360 Edit and Mark (EDMK) instruction for the formatting of alphanumeric fields.

GR (Graphic Control). A control character indicating that the code combinations which follow are to be interpreted in a particular code table, depending upon the particular control character.

CU (Customer Use). A character excluded from future assignment by IBM. These "protected" codes are intended for use by customer systems so that their use will not conflict with a possible future IBM use.

Figure 3 (Continued)

Categories of Control Functions

NUL (Null). The all-zeros character which may serve to accomplish time fill and media fill.

SOH (Start of Heading). A communication control character used at the beginning of a sequence of characters which constitute a machine-sensible address or routing information. Such a sequence is referred to as the heading. An STX character has the effect of terminating a heading.

STX (Start of Text). A communication control character which precedes a sequence of characters that is to be treated as an entity and transmitted through to the ultimate destination. Such a sequence is referred to as text. STX may be used to terminate a sequence of characters started by SOH.

ETX (End of Text). A communication control character used to terminate a sequence of characters started with STX and transmitted as an entity.

EOT (End of Transmission). A communication control character used to indicate the conclusion of a transmission, which may have contained one or more texts and any associated headings.

ENQ (Enquiry). A communication control character used in data communication systems as a request for a response from a remote station. It may be used as a "Who Are You" (WRU) to obtain identification, or may be used to obtain station status, or both.

ACK (Acknowledge). A communication control character transmitted by a receiver as an affirmative response to a sender.

BEL (Bell). A character for use when there is a need to call for human attention. It may control alarm or attention devices.

BS (Backspace). A format effector which controls the movement of the printing position one printing space backward on the same printing line (applicable also to display devices).

HT (Horizontal Tabulation). A format effector which controls the movement of the printing position to the next in a series of predetermined positions along the printing line (applicable also to display devices and the skip function on punched cards).

LF (Line Feed). A format effector which controls the movement of the printing position to the next printing line (also applicable to display devices).

Figure 4
ASCII Control Functions

VT (Vertical Tabulation). A format effector which controls the movement of the printing position to the next in a series of predetermined printing lines (also applicable to display devices).

FF (Form Feed). A format effector which controls the movement of the printing position to the first predetermined printing line on the next form or page (also applicable to display devices).

CR (Carriage Return). A format effector which controls the movement of the printing position to the first printing position on the same printing line (also applicable to display devices).

SO (Shift Out). A control character indicating that the code combinations which follow shall be interpreted as outside of the character set of the standard code table until a Shift In character is reached.

SI (Shift In). A control character indicating that the code combinations which follow shall be interpreted according to the standard code table.

DLE (Data Link Escape). A communication control character which will change the meaning of a limited number of contiguously following characters. It is used exclusively to provide supplementary controls in data communication networks.

DC1, DC2, DC3, DC4 (Device Controls). Characters for the control of ancillary devices associated with data processing or telecommunication systems, more especially switching devices "on" and "off." (If a single "stop" control is required to interrupt or turn off ancillary devices, DC4 is the preferred assignment.)

NAK (Negative Acknowledge). A communication control character transmitted by a receiver as a negative response to a sender.

SYN (Synchronous Idle). A communication control character used by a synchronous transmission system in the absence of any other character to provide a signal from which synchronism may be achieved or retained.

ETB (End of Transmission Block). A communication control character used to indicate the end of a block of data for communication purposes. ETB is used for blocking data where the block structure is not necessarily related to the processing format.

Figure 4 (Continued)

ASCII Control Functions

CAN (Cancel). A control character used to indicate that the data with which it is sent is in error or is to be disregarded.

EM (End of Medium). A control character associated with the sent data which may be used to identify the physical end of the medium, or the end of the used, or wanted, portion of information recorded on a medium. (The position of this character does not necessarily correspond to the physical end of the medium.)

SS (Start or Special Sequence). A control character used to indicate the start of a variable length sequence of characters which have special significance or which are to have special handling.

ESC (Escape). A control character intended to provide code extension (supplementary characters) in general information interchange. The Escape character itself is a prefix affecting the interpretation of a limited number of contiguously following characters.

FS (File Separator), GS (Group Separator), RS (Record Separator) and US (Unit Separator). These information separators may be used within data in optional fashion, except that the hierarchical relationship shall be: FS is the most inclusive, then GS, then RS, and US is least inclusive. (The content and length of a File, Group, Record or Unit are not specified.)

DEL (Delete). This character is used primarily to "erase" or "obliterate" erroneous or unwanted characters in perforated tape. (In the strict sense, DEL is not a control character.)

Figure 4 (Continued)
ASCII Control Functions